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THE VELIGER

A New Species of *Rabdotus* (Gastropoda: Pulmonata: Bulimulidae) from Sonora, with a Description of the Reproductive Anatomy of *Rabdotus nigromontanus*

by

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Abstract. A new species, *Rabdotus* ***milleri*** Hoffman, is described from eastern Sonora, Mexico, on the basis of shell and anatomical evidence. A map of the range and drawing of the reproductive system of *Rabdotus nigromontanus* (Dall, 1897) are included.

INTRODUCTION

Rabdotus nigromontanus (Dall, 1897) is an extremely widespread species, as indicated by my collection and that of Dr. Walter B. Miller. It occupies much of eastern Sonora, Mexico, entering Arizona at one point (Figure 1); it ranges in elevation from 200 to 1240 m. The species was described from shells in poor condition taken from the summit of Black Mountain (now known as La Loma Colorada; 31°14.2′N, 109°17.5′W) at an elevation of ca. 1240 m, the highest elevation at which I have collected this species. To date, no one has published a drawing of the reproductive tract of this widespread species, although at least one new species has been compared to it (MILLER & REEDER, 1984). The type locality appears to be marginal habitat for *R. nigromontanus,* and I have been able to find only a few complete shells, and no live individuals there. However, I have obtained reproductive anatomies from *R. nigromontanus* collected at La Angostura (ca. 150 km south), Magdalena (ca. 175 km west-southwest), and Alamos (ca. 480 km south of the type locality), and found that they do not differ from each other in any significant way. Among these three localities, the length of the penes varied from 10.6 to 11.2 mm, the penial sheaths varied in length from 3.9 to 4.1 mm, the variation in the epiphalluses was from 3.6 to 3.8 mm, the variation in epiphallic ceca was from 4.0 to 4.9 mm, and the length of penial retractor muscles varied from 1.9 to 2.8 mm in length (Figure 2).

Shells of *Rabdotus* that appeared to be slightly different from those of *R. nigromontanus* were found near Sahuaripa, Sonora, Mexico, by Walter B. Miller in August of 1965, while on a collecting trip with his son. These lay, unnamed, in his collection until I became his graduate student and decided to study Bulimulidae in Sonora. In November 1983, we returned to the locality where the shells had been found, only to find that the area had been washed by recent rains, destroying both snails and habitat. On 26 November, the last day of the expedition, a locality rich in shells was located, and just before we had to leave, a single live adult was found by Dr. Miller.

SYSTEMATICS

Family BULIMULIDAE

Genus *Rabdotus* Albers, 1850

Subgenus *Rabdotus* Albers, 1850

Rabdotus ***milleri*** Hoffman, sp. nov.

(Figures 3, 4)

Description of shell of holotype: Shell small, umbilicate, the diameter about six-tenths of the height; uniformly colored light tan, slightly glossy. Embryonic whorls 2 in number, rounded with strong, closely spaced, axial riblets; closely set, fine, spiral threads faintly visible between the riblets of only the first whorl. Post-embryonic whorls moderately rounded, with irregularly spaced growth ribs, and occasional, randomly placed minute pits. Outer lip of peristome sharp, slightly reflexed, inner lip broadly reflected around the umbilicus. Maximum height 16.6 mm, diameter 8.4 mm; 5.4 whorls.

Figure 1

Map of Sonora, Mexico, indicating the ranges and type localities of *Rabdotus* ***milleri*** sp. nov., *R. nigromontanus* (Dall, 1897), and *R. christenseni* Miller & Reeder, 1984.

Reproductive anatomy of holotype: Diagnostic characters are in the penial complex. Penis 4.5 mm in length, largely covered by a thick penial sheath 3.8 mm long; the proximal 1.7 mm of the penis contains highly convoluted glandular diverticula. Epiphallus 4.2 mm long, the lumen of which is lined by shallow longitudinal folds. Epiphallic cecum 2.8 mm long; short penial retractor muscle 2.3 mm long attached to apex of the epiphallic cecum. Vas deferens runs free from approximately 3.5 mm below its origin at base of prostate gland, along free oviduct and vagina, and enters the penial sheath at about 1.3 mm from the genital orifice; it continues proximally within the penial sheath, but externally to the penis, exiting the distal end of the sheath and running alongside the penis and epiphallus until its insertion at the junction of the epiphallus and epiphallic cecum.

Variations in paratypes: A total of 28 adult entire shells and 23 immature or damaged shells was collected. Of the undamaged adult shells, the largest was 18.1 mm in height and 9.4 mm in diameter, and the smallest measured 15.0 mm in height and 8.1 mm in diameter; the mean height was 16.1 mm, and the mean diameter was 8.98 mm. All specimens show all of the characteristics of the holotype except that, among the adult, entire shells, there is variation in the reflection of the outer lip from slight to none.

Disposition of types: Holotype: Santa Barbara Museum of Natural History no. 34490. Paratypes: Universidad Nacional Autonoma de Mexico no. 1203; Academy of Natural Sciences of Philadelphia no. 360593; National Museum of Natural History no. 859066; Field Museum of Natural History no. 215141; University of Texas at El Paso no. 9505; W. B. Miller Collection no. 7340; J. E. Hoffman collection no. 30.

Type locality: Sonora, Mexico; 5.4 km west of the Yaqui River bridge at La Estrella on road to Sahuaripa. In can-

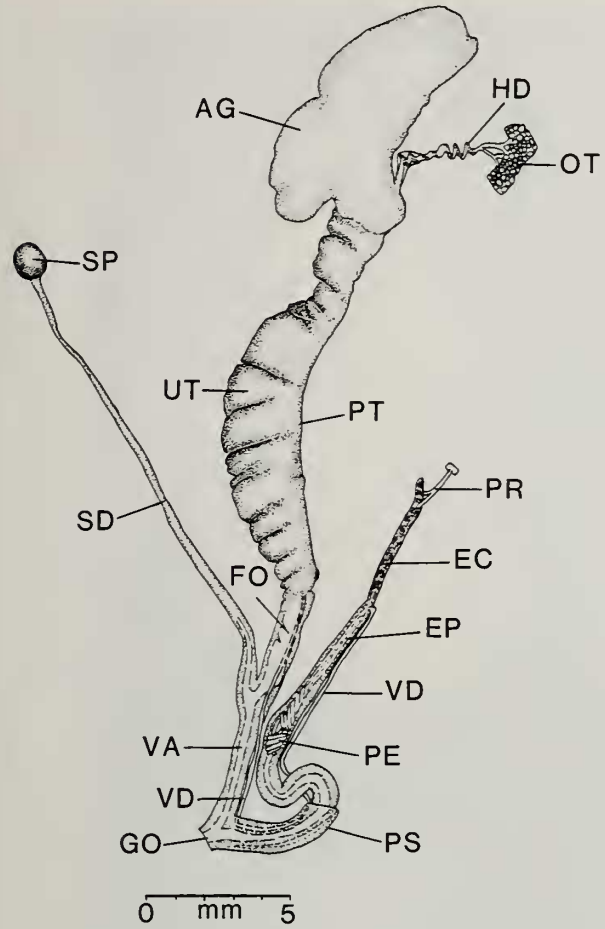


Figure 2

Genitalia of *Rabdotus nigromontanus*, J. E. Hoffman Collection no. 52a. AG, albumen gland; EC, epiphallic cecum; EP, epiphallus; FO, free oviduct; GO, genital orifice; HD, hermaphroditic duct; OT, ovotestis; PE, penis; PR, penial retractor muscle; PS, penial sheath; PT, prostate; SD, spermathecal duct; SP, spermatheca; UT, uterus; VA, vagina; VD, vas deferens.

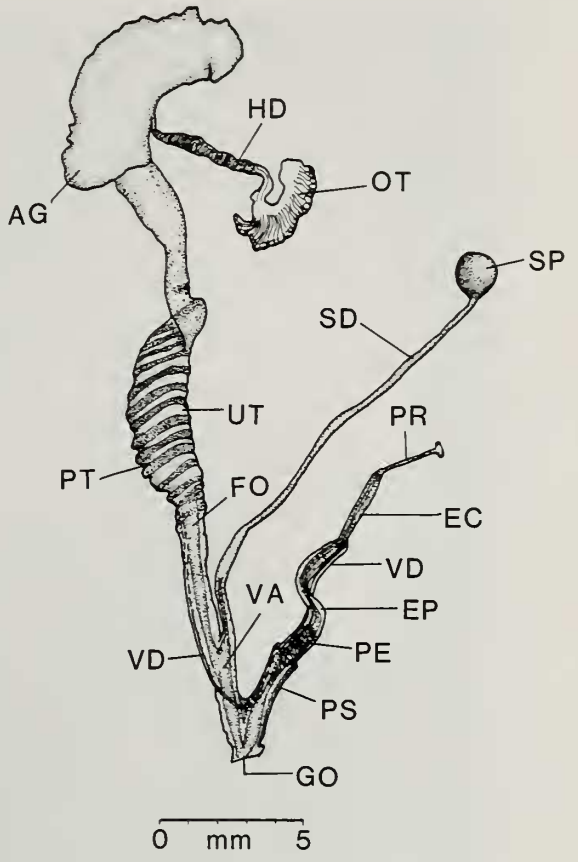


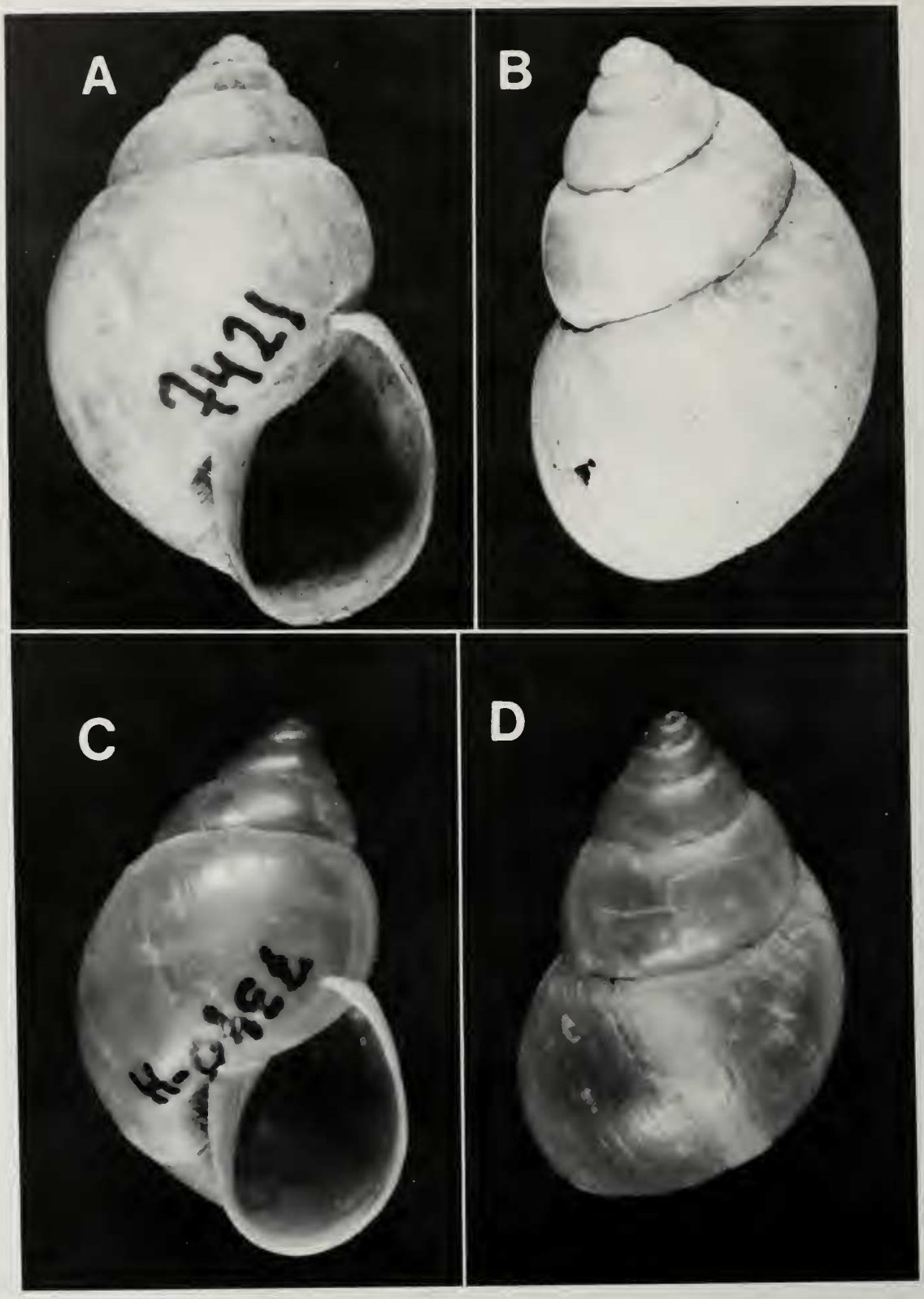
Figure 3

Genitalia of *Rabdotus* ***milleri***, holotype, W. B. Miller Collection no. 7340. AG, albumen gland; EC, epiphallic cecum; EP, epiphallus; FO, free oviduct; GO, genital orifice; HD, hermaphroditic duct; OT, ovotestis; PE, penis; PR, penial retractor muscle; PS, penial sheath; PT, prostate; SD, spermathecal duct; SP, spermatheca; UT, uterus; VA, vagina; VD, vas deferens.

yon extending north from road, in leaf litter below a rockslide; 28°57.1′N, 109°36.7′W; elevation ca. 340 m.

Remarks: *Rabdotus* ***milleri*** is most closely related to *R. nigromontanus* and probably evolved from a common ancestor over a long period of geographical isolation. Its shell differs from that of *R. nigromontanus* only in being somewhat more slender, with a height-diameter ratio of about 1.8, whereas *R. nigromontanus* has an average ratio of 1.54 as determined from 31 specimens from nine lots collected in many parts of the species' range. *Rabdotus* ***milleri*** is more readily distinguished from *R. nigromontanus* by its reproductive anatomy. It has a much shorter penis, almost entirely enclosed by a sheath, which is also much shorter than that of *R. nigromontanus*, whereas the longer sheath of *R. nigromontanus* encloses only the distal one-third of the penis. In addition, its penial retractor muscle inserts at the end of the epiphallic cecum, whereas that of *R. nigromontanus* inserts approximately 1 mm distally from the end.

There has been some disagreement regarding whether the glandular diverticula in the penial complex of *Rabdotus* should be considered part of the penis or part of the epiphallus. The penis is considered to be the part of the penial complex that is evaginable during copulation (Van Mol, 1971); this definition works in theory but is, in fact, almost impossible to apply. Pilsbry (1946) considered the diverticula to be part of the epiphallus, and Miller & Reeder (1984) agreed with him owing to the extreme length of the lower duct in both *R. nigromontanus* and *R. christenseni* as well as because a "pronounced constriction of the lumen" occurred in the latter. On the other hand, Christensen (1978), Breure (1979), and Van Mol (1971) considered the glandular diverticula to be part of


A
B
C
D

the penis. Primarily owing to VAN MOL's (1971) histologic evidence, and for the sake of consistency (more species have been described using their terminology), I must side with the latter authors and consider the glandular diverticula to be part of the penis.

Habitat and distribution: Shells of *Rabdotus* ***milleri*** have been collected in several localities in the Sierra Santo Niño, in addition to the type locality. They have been collected also in the Sierra Chiltepin, 7.8 km west of Sahuaripa. All were collected at elevations between 300 and 400 m in the Sinaloan thornscrub biome (BROWN, 1982). The land rises steeply to the east and southeast, soon entering Madrean evergreen woodland; to the west, the species seems to be limited by the Yaqui River and we were unable to find any sign of this species west of the river, although we did find *Rabdotus baileyi* (Dall, 1893) in both areas. To the north and south there is evidence of geologically recent volcanic activity in areas that seem to lack large land snails; these may be the factors that have isolated this species.

Dominant plants at the type locality include *Cassia biflora, Pachycereus pecten-aboriginum, Stenocereus thurberi, Ceiba acuminata, Sapium biloculare, Acacia cymbispina, Guaiacum coulteri, Fouquieria macdougalii,* and *Bursera* sp.

Etymology: This species is named for Walter B. Miller, friend, mentor, and all around great camper and beer drinker, with whom I have enjoyed many trips into the field. He and his son originally found shells of this species and thought that it might be new. He also collected the holotype and dissected out the reproductive anatomy, making both available for this study.

ACKNOWLEDGMENTS

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Figure 4

A and B. *Rabdotus nigromontanus,* W. B. Miller no. 7421, apertural and dorsal views. C and D. *Rabdotus* ***milleri***, holotype, Santa Barbara Museum of Natural History no. 34490, apertural and dorsal views. All figures ×5.5.